[1, Antiqua; 2, Zierae; 3, Cossus; 4, Russula; 5, Jacobææ; 6, Oo; 7, Parthenias.]

## CURIOSITIES OF BRITISH NATURAL HISTORY.

### British Moths—*continued.*

From the Sphinxes we may pass on to the Moths, constituting the genus Phalæna of Linnæus, but divided by modern naturalists into many distinct families and multitudinous genera. To enter into an analysis of the several families, or to define the genera, is not our present purpose; we aim merely at a representation of such species as may interest the general reader from their beauty or their habits, and at the same time convey an idea of the extent of variation of form which obtains among them. He who would become conversant with entomology must devote himself to the study of it; and, even then, so extensive is the domain that few cultivate more than some one portion of it, and content themselves with a general survey of the rest. To those, however, who have not time to follow out the science, and whose duties lead them to pursuits far removed from any department of zoology, sketches of the animals of our own country in particular often prove very acceptable. Let us, then, now turn to the group before us.

1. The Vapourer moth (Orgyia antiqua), Perfect Insect, Caterpillar, and Pupa and Wingless Female. This species is very diurnal in its habits; it is far from uncommon in our island, and is, indeed, abundant in the neighbourhood of London, occurring even in the streets. Its flight is short, jerking, vacillating, and interrupted; it rests with extended anterior legs and elevated antennæ. The wings are ferruginous; the anterior are clouded with brown, with two undulated and almost obsolete streaks; a pale yellow crescent-shaped spot on the disc, and a snow-white sublunate spot at the lower angle; the hinder wings are unspotted. The female is of a dark cinereous tint, destitute of wings, with serrated antennæ. She is often seen surrounded by crowds of suitors.

The caterpillar, as is the case with those of the genus Orgyia, is thickly covered with fascicles of hair. It is of a dusky colour, spotted with red, with a black

patch on the back; two dark whisker-like tufts of hairs spring from the head; two similar tufts are placed on each side of the body, and one rises from the tail; besides these, there are tufts of long radiating hairs along the sides. The food of the caterpillar consists of the leaves of various trees, especially of the white and black thorn, and is to be found from April to August, when it changes to a dusky yellow pupa. The perfect insect is found from July to October.

2. The Pebble Prominent (Notodonta Ziczac), Perfect Insect, Caterpillar and Pupa. The Pebble Prominent is by no means one of our common moths, nor is it very generally distributed. It has been occasionally taken in the neighbourhood of London, at Darent and Combe Woods, and is said to be rather frequent at Holt, Norfolk. According to Mr. Vigors, it has been found near Dublin. In the male the anterior wings are pale chestnut, brown at the base, with two abbreviated streaks on the anterior margin, between which is a large subquadrate whitish patch, followed posteriorly by a larger ocelliform one, tinged with purplish, intersected by black dashes on the nervures, margined anteriorly by a deep brown lunule, and posteriorly by greyish clouds and a whitish streak; hinder margin with a narrow black line: posterior wings ash-coloured, with a central lunular dusky spot, and a narrow marginal line. The female has the anterior wings of a more uniform chestnut tinge, and the hinder wings mouse-coloured.

The caterpillar has two acute protuberances on its back, and one on the last segment. It is greenish, or ash coloured, with a pale lateral stripe, and a reddish tail. It feeds on the poplar and willow, and in September assumes the pupa state. The perfect insect first appears in May; but from this month to July there is a gradual accession of individuals, though not in great numbers.

3. The Goat moth (Cossus Ligniperda), Perfect Insect, Caterpillar and Pupa. In many parts of our island this fine moth is by no means uncommon. It is found from June to the end of July, infesting oaks, willows, poplars, aspens, &c., upon the wood of which the caterpillar feeds, working its way through the solid substance of the tree, and consequently proving highly destructive, the more especially as it is three years before it assumes the pupa state.

The perfect insect measures from two inches ten lines to upwards of three inches, or in the female to three inches six or nine lines, in expanse of wings. The anterior pair are clouded with greyish and brown, with numerous transverse irregular black streaks and reticulations. The posterior wings are dusky, with obscure reticulated streaks towards the hinder margin. This moth is not very active, at least during the day, and may be observed reposing amidst the foliage of the trees, which it habitually frequents.

The caterpillar emits a most disgusting odour; it attains to a huge size, and is of a dull rufescent colour, with large shining red patches on the back, and two triangular black spots behind the head, which latter is black. Before it changes to a pupa state, which is generally in the autumn, the caterpillar searches for a convenient place, and then shrouds itself in a case composed of pieces of wood, which it unites together by means of a strong glutinous substance, lining the whole with silk. The pupa is brown, and strongly denticulated on the margin of each segment.

4. The Clouded Buff moth (Euthemonia Russula, Stephens), Perfect Insect, Caterpillar and Pupa.

The Clouded Buff moth measures about an inch and a half in the expanse of its wings. It is a common insect on heaths and commons; in the New Forest it is abundant and is in considerable plenty on Stockton Heath and in the neighbourhood of York, and, according to the Rev. L. Jenyns, is not uncommon in Bottisham and Horningsea fens. The male generally flies in the afternoon, and may be observed during the day resting on furze-bushes, and the rough shrubs of the common, but the female is seldom to be seen, as she generally conceals herself at the roots of plants or bushes, amidst dense vegetation. She is moreover far more sluggish in her habits than the male, numbers of the latter being often noticed active on the wing around her resting-place.

In the male the chest and anterior wings are pale yellow, the anterior margin near the apex, the inner margin, and long basal hairs bright sanguineous; posterior wings and abdomen yellowish white, the former with a dusky lunate spot on the disc, and a marginal fringe of the same colour. Shaft of the antennæ and legs rufescent. In the female the antennæ, head, thorax, and anterior wings are reddish or fulvo-rufous, the margins of the latter, the nervures and central lunule, bright sanguineous. The posterior wings are fulvous; with the base, an ovate spot near the centre, and the margin dull black.

The caterpillar is of a dusky tint, with yellow spots along the sides, and dull orange hair closely set in fascicles. Various grasses, plantain, hound's-tongue, &c. constitute its food. It changes in May to a reddish brown pupa, shrouded in a web upon the ground. The perfect insect appears in June.

5. The Pink Underwing (Callomorpha Jacobææ), Perfect Insect, Caterpillar and Pupa.

This beautiful moth is extremely abundant in certain localities. It is common around London, but we have observed it in multitudes in the neighbourhood of Herne Bay, and on the hills around Dover. It is said to be common in Cambridgeshire and in Devonshire; it is numerous in Epping forest, and also in Darent-wood. This moth is partially diurnal in its habits, and in favourite spots great numbers are often seen together, flitting about or resting on the stems of the ragwort. The head, body, and limbs are black; the anterior wings ashy brown, with a longitudinal streak of scarlet parallel to the anterior margin, and two roundish spots of the same colour on the external margin. The hinder wings are bright sanguineous on both surfaces, with a posterior narrow fringe of ashy brown.

The caterpillar is slightly hairy, and alternately ringed with black and yellow; it feeds upon the flowers of the ragwort, and spins a loose cocoon on the stems of the plant, within which it assumes its pupa state, the perfect insect emerging the following May. The caterpillar of this species is to a certain extent gregarious, numbers infesting the same plant, and weaving their respective cocoons on its stems.

6. The Double-O moth (Cymatophora Oo), Perfect Insect, Caterpillar and Pupa.

This moth is local in its distribution, being rare in some places and tolerably abundant in others; it is by no means common in the immediate vicinity of London, but, according to Stephens, has been taken rather plentifully near Chigwell Row, in Epping forest, and at Darent-wood. He adds that he has taken it on Clandon Common, and that it has been found in other neighbouring places. It is stated to occur at Leatherhead in Surrey, and to have been found near York, on the oak. It is nocturnal in its habits.

The head and thorax are of a pale ochre yellow, sprinkled with dusky; the anterior wings are pale yellow, with a pale ferruginous mark near the base, and finely reticulated with the same colour, two rings something like OO appearing in the centre of the wings. Reticulations and a narrow line are conspicuous along the outer margin. The hinder wings whitish, with a tinge of buffy yellow. Expanse of wings about one inch and a quarter.

The caterpillar has the head black, the body ferruginous with white spots and lines. It feeds on the oak, and the perfect insect appears in May and June.

7. The Orange Underwing (Brephia Parthenias), Perfect Insect, Caterpillar, and Pupa.

The Brephæ, observes Mr. Stephens, "are distinguished by the beauty of the under surface, and the liveliness of the colouring of the posterior wings, which are generally orange or flavescent with black or dusky fasciæ and margins;" the Palpi are concealed, and the head is densely pilose.

This elegant species is diurnal in its habits, appearing early in the spring, and flitting about in wooded places on rapid but vacillating pinions, generally over the tops of the bushes or patches of underwood, and occasionally descending and settling near little pools of water, but ever on the alert, and flitting off on the least alarm. It is very local in its distribution, being common in a few places only. Mr. Doubleday instances Ongar Park woods, and Mr. Stephens says that near Hertford, Highgate, Colney-hatch, and at Combe-wood he has seen and captured specimens, and that at certain seasons it is not uncommon.

The general colour is fuscous. The anterior wings are sprinkled with cinereous, and marked with several obscure whitish, strigæ; two decided spots are seated on the anterior margin; the first forming a transverse bar. The posterior wings are dull orange, with the base and inner margin broadly black, with an interrupted transverse bar of the same colour, and also a posterior marginal fringe. We may observe, however, that in the arrangement of the markings there is considerable variation. The caterpillar is yellowish green, with a bluish black lateral line, and some black spots. It feeds upon the leaves of the poplar and oak. The perfect insect appears in March.

In looking over the group of moths, thus briefly described, the most remarkable is the Goat moth (Cossus ligniperda). It is among the finest of our British species, and the caterpillar was selected by Lyonnet as the subject of his minute and laborious dissection, the results of which are described and delineated in his 'Traité anatomique de la Chenille du Saule,' the plates being engraved by the author. Of this work Cuvier says, "It is at the same time the chef-d'œuvre of anatomy and of engraving;" and certainly it is a monument of patience, industry, and skill, conspicuous among the works of science. The caterpillar of this moth we have stated to feed on solid wood, boring galleries as it gnaws its way into the heart of the oak, willow, or poplar; and it may occasion no little surprise to learn that a caterpillar is capable of mining through the hard trunks of trees: such, however, is the fact; and Cuvier says it emits from the mouth an acrid and fetid liquor, which, it would appear, has the property of softening the wood; of this, however, we are by no means certain.

As this caterpillar lives for the space of three years before undergoing its final change, it is not unreasonable to ask in what manner does it spend the colder months of the winter? We may answer—apparently in a state of hybernation or torpidity. Not contented with the maze of galleries it has already scooped out, and which perhaps do not afford it sufficient protection, it begins before the arrival of the severe season to scoop out a cell or chamber in the bole of the tree, if it does not find one already prepared; and to this it retires, and, bending its body, sinks into repose. Mr. Rennie informs us that on sawing off a portion of an old poplar in the winter of 1827, he found such a cell with a caterpillar coiled up in it. "It had not, however," he says, "been contented with the bare walls of the retreat, which it had hewn out of the tree, for it had lined it with a fabric as thick as coarse broad-cloth, and equally warm, composed of the raspings of the wood scooped out of the cell, united with the strong silk which so many species of caterpillar are capable of spinning. In this snug retreat the caterpillar, if it had not been disturbed, would have spent the winter without eating, but upon being removed into a warm room, and placed under a glass along with some pieces of wood, which it might eat, if so inclined, it was roused for a time from its dormant state, and began to move about. It was not long, however, in constructing a new cell for itself, no less ingenious than the former. It either could not gnaw into the fir plank, on which it was placed with a glass over it, or it did not choose to do so, for it left it untouched, and made it the basis of the edifice it began to construct. It formed in fact a covering for itself precisely like the one from which we had previously dislodged it, composed of raspings of wood given it as food, the largest piece of which was employed as a substantial covering and protection for the whole. It remained in this retreat motionless and without food, till revived by the warmth of the ensuing spring, when it gnawed its way out, and began to eat voraciously, to make up for its long fast." The cell, or rather cocoon, in which the pupa state is assumed, and the last change undergone, is of similar manufacture, but of stronger and closer texture. It is well known that a large caterpillar feeding on the wood of the oak, according to Pliny, was esteemed by the Romans a delicacy for the table, and was purposely fattened with 'farina.' Ray and Linnæus are inclined to think that the caterpillar thus prized was the present; but it is impossible to arrive at a certainty on the subject. It is, however, surprising to find that the taste of the luxurious Romans agrees with that of the savage natives of Australia as respects the use for food of wood-eating caterpillars. Besides the Bugong moth, which is very oily, and accounted when pounded delicious fare, the Australians relish certain caterpillars which feed on the substance of the grass-tree and the wattle-tree: they are eaten either raw or roasted; and when the natives are taunted with eating such disgusting food, they invariably retort upon the European by accusing him of eating raw oysters, which they regard with perfect horror.

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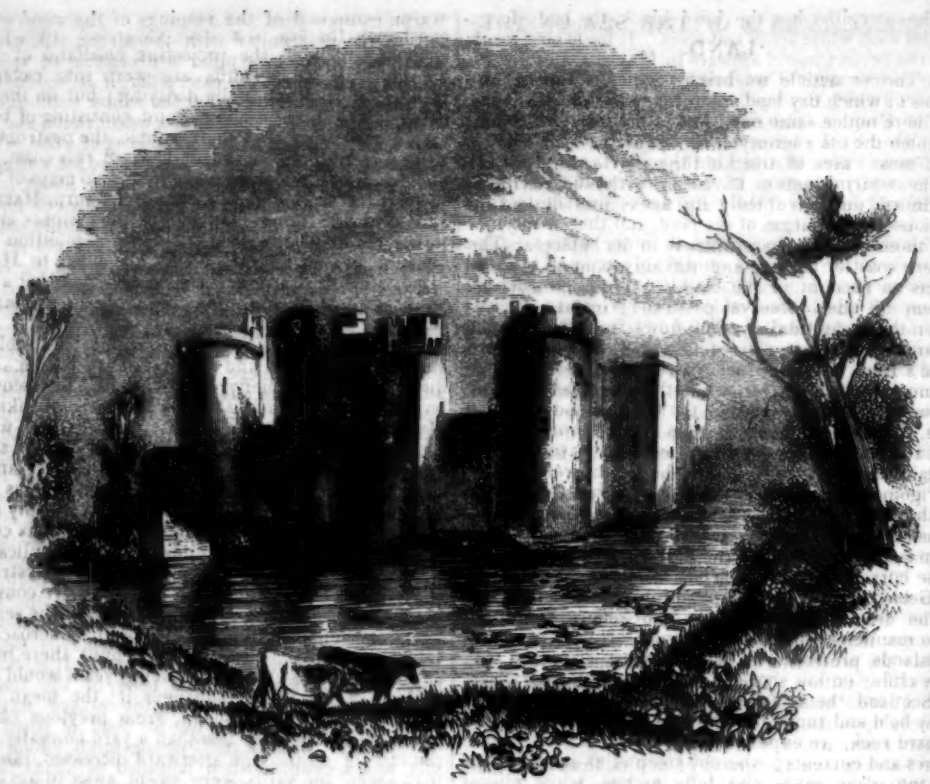
*The Doctor in Abyssinia.*—Whilst invalids of all classes daily flocked to the camp of the Europeans for medical assistance, applications were not wanting from the palace in proof of the reputation acquired. One of the princesses royal, who had been lodged with the illustrious visitor from Achun-Kurra, in the crimson pavilion presented by the British government, found herself in need of advice; and, on being visited, lay concealed beneath the basket pedestal of a wicker dining-table, whence her sprained foot was thrust forth for inspection. Divers respectable duennas of the royal kitchen, who had been severely scalded by the bursting of a pottage-cauldron, were also treated with success when they had been given over by the body-physician, at whose merciless hands the sobbing patients had been plastered over with honey and soot; and a mutton-bone was extracted from the throat of a page, where it had been firmly wedged for three days. But the cure which elicited the most unqualified and universal amazement, was that of a favourite Baalomaal, who, labouring under a fit of apoplexy, which had deprived him of animation, was suddenly revived by venesection, after fumigation with *ashhoko goomun* had been tried without the smallest avail, and preparations were already commencing for his interment.—Medicine, in fact, now engrossed the entire of the Royal attention. Phials and drugs without number were sent to the tent, with a request that they might be so labelled as to admit of the proper dose being administered to patients labouring under complaints for the removal of which they were respectively adapted. Two or more invalids, who objected to be seen, were certain to arrive at the palace within every four-and-twenty hours; and no subterfuge that ingenuity could devise was left untried by which to augment the already ample stock of pills on hand.—*Major Harris's Highlands of Ethiopia.*



[Bodiam Castle, Sussex.]

## BODIAM CASTLE.

Bodiam, or Bodiham, Castle is situated on the east side of the county of Sussex. A short distance to the west of the castle is the village of Bodiam, which is four miles north-east from Robertsbridge, and about twelve miles west-north-west from Rye. Bodiam Castle is on the north side of the river Rother, whence water is artificially conducted to supply the broad moat which surrounds the castle, and which looks like a small lake. The form of the castle is nearly a square, with a round tower at each of the four corners, and a square tower in the centre of the east, west, and south sides. The great gateway is in the centre of the north side, and is flanked by two square towers, with machicolated battlements,* and the entrance is further defended by an iron portcullis. Above the gateway, on the exterior wall, are three escutcheons with the arms of Bodiam, Dalyngrigge, and Wardeux. The approach to the great entrance is by a causeway, which was defended by an advanced gate, of which there are still some remains. There is a smaller gateway on the south side, which had an inner as well as an outer gate, but the inner gate has been destroyed, and a cottage built on the site. The towers are lighted by loopholes and small windows little better than loopholes. The length of the east and west sides, measured from centre to centre of the corner towers, is one hundred and sixty-five feet; the length of the north and south sides, similarly measured, is one hundred and fifty feet. The remains of the chapel, the hall, the kitchen, and other apartments and offices, are parallel to the main walls, and leave in the centre an open area of eighty-seven feet by seventy-eight feet.

The situation of the castle is low. The style of architecture is French, rather than English, and is similar to that of the castle of Amberley, in the same county, which was built about the same time. Bodiam Castle is a noble pile of ruins, and with its massy but crumbling towers, mantled with ivy and reflected in the broad moat, produces an effect highly picturesque, filling the mind with reflections not unpleasing on times of insecurity, violence, and bloodshed which have fortunately long since passed away.

Bodiam Castle was erected by Sir Edward Dalyngrigge in the year 1386. Sir Edward belonged to a family of great consequence in Sussex, and was engaged in the French wars of Edward III. He married the heiress of the family of Wardeux, who were lords of Bodiam. In the 31st year of the reign of Henry VI., Philippa, the daughter and heiress of Sir Richard Dalyngrudge, married Sir Thomas Lewknor, who also belonged to a family of high station in the county, several members of which had been knights of the shire, and nine of them high sheriffs. In the civil war of Charles I. the Lewknor who was then proprietor of the castle was a firm loyalist; the consequence of which was, that his castle was dismantled by Waller, and his property passed by alienation to the Earl of Thanet, from whom the lordship of Bodiam was purchased by Sir Thomas Webster, and descended with his other estates to Sir Godfrey Webster: it has now become the property of the Fullers, by whom it was purchased in order to prevent as much as possible the decay and dilapidation of the castle.

* In castellated architecture the battlements frequently project beyond the wall, leaving intervals suitable for throwing down stones, or pouring melted metal, or discharging missiles perpendicularly on the heads of the assailants. Such openings are called machicolations, and such a battlement is said to be machicolated.

## ENCROACHMENTS OF THE SEA ON THE LAND.

In a former article we briefly described some of the modes in which dry land encroaches on the sea. We may here notice some examples of the opposite action, in which the sea encroaches on the land.

In most cases of this kind the effects are produced by the wearing action of tides, waves, and currents, continued uninterruptedly for ages; first destroying portions of the margin of the land, and then transporting those broken fragments to other places. The eastern coast of Britain is remarkably exposed to these effects on account of the double current, or a double system of tides, observable in the German Ocean. When the great tidal current flows from the Atlantic towards Britain, it divides into two portions at the Land's End; one of which passes along the English Channel towards Dover, while the other passes round the west of Britain towards the Orkney and Shetland Isles. This latter current then bends round to the east and the south, and flows on southward between Britain and Denmark. Here the two currents meet; one going northward from Dover Straits, the other southward from the Orkneys; and the action thus becomes so considerable, that the shore is ground or worn away by the incessant passing and repassing of these currents. We will select from Mr. Lyell's work on Geology such details as illustrate this action.

The destructive process on the eastern shore has been manifested on all the different varieties of coast; on islands, promontories, bays, and estuaries; on bold lofty cliffs; on low shores. Towards the northern part of Scotland the action has been displayed in wearing away bold and rugged cliffs. The Shetlands, composed of hard rock, are exposed to very violent action from waves and currents; whereby steep cliffs are hollowed out into deep caves and lofty arches, while almost every promontory ends in a cluster of rocks, imitating the forms of columns, pinnacles, and obelisks. Huge blocks of stone are torn from their beds by the violence of the waves, and hurled along to a considerable distance. An instance has been known in which a mass of rock, eight feet long, seven wide, and five thick, was rent from its bed by the waves, and carried to a distance of a hundred feet. In other cases the sea has forced for itself a passage through rocks of the hardest porphyry. Rocky islands have by this means become mere clusters of rocks, the last shreds of masses once continuous; and thus among the Shetland Islands are to be seen isolated rocks of most fantastic form; in one case looking, at a distance, like a fleet of small vessels with spread sails; in others like needles, pyramids, huge icicles; while others defy any correct description as to form.

Passing southward along the east coast of Scotland, it is found that the destroying action shows itself more in filling up estuaries, and gradually attacking seaport towns. An old town called Findhorn, in Morayshire, has been swept away by the sea. The village of Mathers, in Kincardineshire, built on an ancient shingle beach, was carried away by the waves of the sea in one night, in 1795. At Arbroath, which stands on a rock of red sandstone, gardens and houses have been carried away since the commencement of the present century by encroachments of the sea. The lighthouses built at the mouth of the Tay have had to be removed farther inland, on account of the approach of the sea. At Newhaven an arsenal and dock, built in the fifteenth century, have been overflowed by the sea.

Along the east coast of England, from Northumberland to Kent, examples have been shown of the same system of destruction. At Bamborough, at Holy Island, and at Hartlepool, the sea has made considerable encroachments; while Tynemouth Castle, which now overhangs the sea, was once separated from it by a strip of land. At the projecting headland of Flamborough, the chalk cliffs are worn into caves and needles, and are gradually decaying; but on the coast between this spot and Spurn Point, consisting of beds of clay, gravel, sand, and chalk rubble, the destruction is still more rapid. There are now, off this coast, sandbanks in the sea which were marked in old maps of Yorkshire as the sites of the villages of Auburn, Hartburn, and Hyde. Hornsea, Owthorne, and Kilnsea are suffering gradually the same process of demolition. Ravenspur, which was at one time a rival to Hull in importance, has been so utterly destroyed that a sandbank, covered at high-tide, but dry at low, marks its site.

The shore of Lincolnshire has exhibited a double process of destruction and reclamation. The maritime district consists chiefly of lands that lie below the level of the sea, being protected by embankments. Much of this was at a remote period a well-wooded country; it was afterward overflowed by the sea; it has since been recovered by embankments; and the system of drainage now being carried on has for its object to make the district still more worthy of the name of dry land. So low is the coast of this county, that the wearing away of cliffs is hardly applicable to it; but in Norfolk and Suffolk this sort of destruction is going on. At Hunstanton the cliffs are constantly being undermined and precipitated into the sea. At Sherringham a striking instance of this encroachment has been exhibited. An inn was built there in 1805, and it was computed that seventy years would elapse before the sea would endanger it; the mean loss of land having been computed, from previous observations, to be somewhat less than a yard annually. But the rate of destruction afterward increased, insomuch that seventeen yards were swept away in six years; and in 1829 only a very small garden intervened between the inn and the sea. In that same year there was a depth of twenty feet of water at a spot where, less than fifty years before, there had stood a cliff fifty feet high, with houses upon it. The flag-staff of the Preventive Service station, near the same spot, was thrice moved in fifteen years, on account of the encroachment of the sea.

The ancient towns of Cromer, Shipden, Wimpwell, and Eccles have all disappeared. The Cromer of the present day is far inland of the former, and seems itself destined to destruction at some future day. There is a ruined tower of the church of Eccles still visible, the only relic of the town. So early as the reign of James I., the inhabitants prayed for a remission of taxation, on the ground that all their houses, except fourteen, had been destroyed by the sea. At Yarmouth a low tongue of sandy land stretches almost entirely across the mouth of what was once an estuary extending as far as Norwich; this is formed of sand brought down and lodged by the currents, and serves as a barrier to protect this part of the coast from wasting.

North and south of Lowestoffe the cliffs are gradually crumbling; at Corton, at Pakefield, and particularly at Dunwich. There are records to show that this last-named place has been subject to these visitations for eight or nine hundred years; for two tracts of land which had been taxed in the time of Edward the Confessor are mentioned in Domesday-Book as having been devoured by the sea. At subsequent periods the losses continued—at one time of a monastery, at another of several churches, afterwards of the old port, then of four hundred houses at once, of the church of St. Leonard, the high road, the townhall, the gaol, &c. The inhabitants retreated inland as fast as the sea encroached upon them, so that the name is still retained. There

was once a wood situated a mile and a half eastward of the present town of Dunwich, the site of which must therefore now be that distance to seawards.

Aldborough, Bawdsey, and other parts of the Suffolk coast, have suffered in a similar manner, if not to the same degree; and when we arrive at the Essex coast, we find the same changes in progress. Harwich is said to have owed its rise to the destruction of Orwell, a town which was overwhelmed by an inroad of the sea many centuries ago. Mr. Lyell thinks that the promontory on which Harwich stands will become an island in half a century; for he has found that the sea is gradually cutting away the isthmus which connects it with the land; and he hints that the inhabitants are hastening the destruction of their own town, by selling for cement the stones which roll down upon the beach, and which, if allowed to remain, might help to stem the action of the sea.

On the coast of Kent we meet with the interesting examples furnished by Reculver and the Isle of Sheppey. This isle is about six miles long by four wide. The cliffs are wearing away rapidly; the church of Minster, once in the middle of the island, is now on the coast; and it is supposed that if the present rate of destruction continues, the whole island will be annihilated in fifty years. Farther eastward we find a nearly straight line of coast where was once Herne Bay. It is true that name is still given to the spot; but it bears very little resemblance to a bay, for the waves and currents have by degrees swept away the ancient headlands. There was formerly a small promontory jutting out where the present pier is built; but this has been wholly annihilated. Reculver, between Herne Bay and Margate, was an important military station in the time of the Romans, and was in the time of Henry the Eighth distant one mile from the sea. In 1781 there was still a considerable space intervening between the church and the sea. The walls of the ancient Roman encampment, distant eighty yards from the church, were destroyed in 1780; and since then the sea has swallowed up the strip of land close to the church. The church still remains, with its twin towers of curious shape serving as a landmark to seamen; but it would have been destroyed before now had it not been for an artificial causeway of stones and wooden piles, erected as a barrier between it and the sea.

In the cliffs round near the North Foreland, the coast wears away at the rate of about two feet in a year; while nearer to Ramsgate the rate of destruction is somewhat greater. The Goodwin Sands, situated opposite this part of the coast, are believed to have been once dry land, and to have formed an island which was gradually washed away; for there is a tradition that the estates of Earl Goodwin, the father of Harold, were situated here; and it has been proved that there is a clayey foundation at a depth of a few feet beneath the loose sand. If this be so, there was probably an island formed of clay, which was gradually overwhelmed by the sea, and on which sand has been gradually deposited to a depth of fifteen feet.

The cliffs near Dover have been gradually worn by the sea, especially the "Shakspere" cliff. It will become an interesting question in future years how far the stupendous engineering works executed by Mr. Cubitt in this locality will enable the old cliffs to battle against their destructive enemy.

It has often been a favourite speculation that England and France were once joined by a rocky ridge extending from Folkestone or Dover to somewhere between Calais and Boulogne, and that this ridge has been worn away by the sea. The Straits of Dover are so shallow at one part, and the contour of the two coasts corresponds so much, that the opinion is regarded as being not improbable.

At Folkestone and at Hythe the cliffs exhibit proofs of the same wearing action; but between Hythe and Rye the land has gained from the sea the rich level tract known as Romney Marsh, which has been formed of the silt, or fine mud, deposited by the current flowing from west to east through the English Channel. Rye was once destroyed by the sea; but it is now two miles distant from it. Westward of this point we come to Hastings, where the cliffs are being gradually worn; and still more at Beachy Head. The whole coast of Sussex has been incessantly encroached upon by the sea from time immemorial; sometimes almost insensibly, at other times with violence. During a period of no more than eighty years, there are notices of about twenty inroads of the sea, in which tracts of land of from twenty to four hundred acres in extent were overwhelmed at once. In the reign of Elizabeth, Brighton was situated on that tract where the chain-pier now extends into the sea, being, in fact, situated on the beach under the cliffs, from which situation all the houses were washed away one by one.

Farther westward, on the Hampshire coast, the shore exhibits the effects of similar actions; and the same remark is applicable to Dorsetshire. The cliffs between Hurst Castle and Christchurch are so much undermined, that, within the memory of persons now living, it has been found necessary to remove the coast-road farther inland three different times. The church of Hadwell was once in the middle of the parish, though now near the sea. The peninsulas of Purbeck and Portland are gradually wasting away. In 1665 the cliffs adjoining the principal quarries in Portland gave way to the extent of one hundred yards, and fell into the sea; and in December, 1734, a land-slip to the extent of a hundred and fifty yards occurred on the east side of the isle. In 1792 a much more notable loss of land occurred, which was thus described in Hutchins's 'History of Dorset':—"Early in the morning the road was observed to crack; this continued increasing, and before two o'clock the ground had sunk several feet, and was in one continued motion, but attended with no other noise than what was occasioned by the separation of the roots and brambles, and now and then a falling rock. At night it seemed to stop a little, but soon moved again; and before morning the ground, from the top of the cliff to the water side, had sunk in some places fifty feet perpendicular. The extent of ground that moved was about a mile and a quarter from north to south, and six hundred yards from east to west."

At Lyme Regis the cliffs have fallen away at the rate of about a yard per year. Between Lyme Regis and Axmouth, in 1839, occurred that extraordinary land-slip described in our No. 505, which so well illustrates the destructive action of the sea on the coasts.

Near Penzance, in Cornwall, there is a projecting tongue of land, called 'The Green,' formed of granitic sand, from which more than thirty acres of pasture land have been gradually swept away in the course of the last two or three centuries. It is also said that St. Michael's Mount, now an insular rock, was formerly situated in a wood, several miles from the sea; and there are many indications that Cornwall is silently undergoing the same kind of destruction of coast as the other counties which we have mentioned.

Without following the remaining coasts of Britain, or passing to the Continent, these few details will suffice to convey an idea of the manner in which the sea encroaches on the land by wearing away the coast.

## ON COLOURED AND VARIEGATED METALS.

METALS are among the few substances which are not commonly coloured by any artificial means, as a matter of ornament. Gold, silver, copper, brass, tin, steel, &c. have each their peculiar beauty when polished, and are in most cases left without any attempt at colouring. Iron is often coated with paint, quite as much to prevent it from oxidizing as to give it an ornamental appearance; and the same thing may be said of some other applications of metals; but the metallic lustre, in the majority of cases, is deemed more pleasing than any application of colour to metallic surfaces. There are, however, a few exceptions to this rule, which involve some rather peculiar details.

Coloured *foil* is one of the most common of these specimens. This foil is a very thin sheet or leaf of metal, used by the jewellers to place under a precious stone, in order to make it look transparent and to modify or heighten the colour; the lustre of the gem being heightened by a polished but colourless foil, the tint lightened by a lightly coloured foil, and lowered by one of dark colour. Such sheets are made of copper, of tin, of gold, of silver, or of some mixed metal. The copper foil, which is produced chiefly in Germany, is made somewhat in the following manner:—A very thin plate of copper is beaten gently on a polished steel anvil with a polished hammer, till it is as thin as writing paper; or it is brought to the same degree of thinness by a rolling-mill. The thin sheet thus produced is heated between iron plates, then boiled in an alkaline liquid to remove the colour, and then again hammered or rolled to the required thinness. The foil is polished on a convex plate of polished copper, whose surface is coated with chalk and water. The leaves of tin, which, when combined with quicksilver, form the under coating of a looking-glass, are brought to a thin and leaf-like state by nearly similar means; and so are likewise the square leaves of copper which are sold under the name of Dutch gold or Dutch metal. Indeed any metal which possesses a tolerable degree of malleability may be hammered or rolled out to a thinness which is more analogous to that of a leaf than to a sheet of metal.

The method of imparting brilliant colours to the metallic foil used for jewellery and other purposes, was first practised on the continent, and indeed it is still rather a foreign than an English branch of art. The basis of all such colours is a clear and transparent varnish, so tinted that it shall, with the natural colour of the metal beneath, give the required hue. For a blue colour, foils of copper, or of silvered-copper, are selected; and for other colours the nature of the foil selected depends on the experience of the workman. The leaves of metal require a little preparation before they are fitted to receive the hue of colour. A gum or glue of isinglass is prepared by steeping in cold water, boiling, and straining; and after the foil has been dipped in a weak solution of nitric acid, as a means of cleansing it, it is coated with the melted isinglass size by means of a camel-hair pencil. When this layer is dry, the metal is ready to receive the colouring ingredient, which varies in its character according to the tint required to be produced. For a blue colour, Prussian blue is the main ingredient, or else sulphate of indigo; for green, either acetate of copper or a mixture of blue and yellow; for red, either cochineal or sandal-wood; for violet, the tincture of litmus; for ruby, carmine; while the intermediate colours are mostly produced by combination of some two or more of the preceding. These various colours are laid on the foil in a liquid state; and when the tint is produced, and the surface quite dry, an external coating of colourless varnish completes the preparation, whereby the colour is protected from injury, a gloss is imparted to the metal, and the colour is developed with brilliancy.

Some years ago a kind of coloured or ornamented metal attracted a good deal of notice, from the singular beauty and richness of appearance, and from the difficulty of understanding how it could be produced. This is called by the French *moiré métallique*, a name implying clouded or watered metal. The metal has a singular crystallized appearance, in some respects similar to frost on a window in a winter's day, but far more brilliant and diversified.

The moiré métallique is a French production. It is formed of tinned iron plates, and the peculiar effect at the surface is produced by exposing the tin to the chemical action of acids. The application of this substance to the purposes of ornament was made about the year 1817; and the patentee, M. Allard, had to defend his patent against many infringements, in the French courts. The circumstances which were explained during these trials elicited the fact that the moiré is formed by the action of the tin on the iron at the place of contact; and that the effect of the acid is to dissolve and remove the outer surface of the tin so as to make the moiré visible; in short, that the acid does not produce the moiré, but only develops that which is already produced.

The mode of preparing the moiré métallique, as described in a French Cyclopædia, is very simple. Common tin plate consists of a very thin film of tin placed upon the surface of, and united to, a piece of sheet iron; and it is believed that the chemical action of the two metals one on another gives the varied and clouded effect that constitutes the moiré. As this clouded effect, however, does not exhibit itself through the whole thickness of the film of tin, and cannot be seen when the tinned iron is in the usual state, the art consists in removing just so much of the tin as will lay bare the united film of the two metals. This is a point of much nicety, for if the acid employed for this purpose be allowed to penetrate too deeply, it will lay bare some of the iron, and there will result dark spots instead of the silvery lustre and pearly appearance of the moiré. The chemical agent employed for this purpose does not seem to be very precise in its character, many different mixtures being named as fitted for the purpose; comprising among them nitric acid, muriatic acid, sulphuric acid, muriate of soda, muriate of ammonia, and distilled water; the one, however, which may be taken as the nearest type of the whole is a mixture of nitric acid, muriatic acid, and distilled water, in about equal quantities.

When the acid liquor is prepared, the plate of tinned iron, after being slightly heated, is sponged over with the acid liquor. The acid begins immediately to act on the tin; and as soon as the workman sees the moiré manifested in a distinct manner, he instantly plunges the sheet into a vessel containing clean water, and washes off the acid and the dissolved tin with a feather or a bit of cotton, but so gently as not to disturb the thin metallic film which constitutes the moiré. In proportion as the plate is more highly heated, or the acid more concentrated, the action on the metal becomes more rapid, so that the time required for producing the due effect varies from one minute to ten minutes, according to these circumstances. The acid is laid on very evenly and regularly, as the moiré would be more readily destroyed at any part where the acid lay in greater quantity.

When the moiré has been properly developed, the plate is carefully dried, and either varnished at once to protect it from injury, or temporarily coated with gum until varnish can be applied. The moiré, thus

prepared, has a silvery or pearly appearance; but it may have any required colour imparted to it by means of coloured varnishes.

A kind of moiré is occasionally produced without the aid of acids, by exposing the plate of tinned iron to such a heat as will melt the tin. While thus in a melted state, if the tin be allowed to cool gradually, the surface will present a crystallization or moiré of a peculiar kind; if suddenly cooled by being plunged in cold water, the moiré assumes a different character; if the surface be unequally cooled by sprinkling cold water upon certain parts of it, a more diversified moiré results; and if a current of cold air be blown upon it, a yet further diversity is produced. So, on the other hand, by heating the tinned iron unequally, a moiré is developed; a device or design may be traced on the tinned surface by the point of a flame urged by a blow-pipe; and as the tin, which is thus liquified all along the course of the flame, crystallizes as it cools in a form different from that which the other parts of the surface present, the pearly moiré results.

Some years ago M. Nobili, a distinguished natural philosopher of Reggio, brought into notice a very beautiful mode of colouring metals, by an agency of a simple and remarkable nature. The plates which he exhibited as examples of the art of *metallochromie*, or metal-colouring, were sheets of steel, ornamented with regularly disposed spots, coloured of a greenish yellow, pure yellow, blue, and other colours, somewhat similar to those exhibited by bright copper plates when exposed to the action of heat; the backs of the plates being of a uniform brown colour.

M. Nobili presented some of the plates to the French Society of Arts in 1828; and the society appointed a committee of its members to report on the nature and merits of the invention. In the Report, which was drawn up by M. Gaulthier de Claubry, it was stated that the colours were very brilliant, the tints well harmonised, and so durable that they could not be destroyed except by a high heat. M. Nobili appears to have so disposed the coloured spots on his steel plates as to lead to the production of figures and devices; and from the following passage in the Report the committee seem to have viewed the method as the opening of a new kind of decorative art:—"We can easily form a just idea of the extent to which it might be possible to carry this branch of manufacture, when we remark that many metals assume their colours in very different orders by the application of heat; and we can easily conceive that, in the hands of a skilful man, and one well conversant with commerce, the greatest advantages might be derived from the employment of this new branch of industry. Thus, for instance, nothing presents more harmony than gold, as its tints are very different from those afforded by heating steel. It is upon this last metal that all the designs presented by M. Nobili have been executed. Silver likewise affords different colours on applying heat; and an experienced artist cannot fail to make many fine applications of M. Nobili's process."

Nobili did not explain to the committee the mode in which he produced his metallochromes, and no one at that time seems to have guessed rightly as to the mode of proceeding. He continued to practise the art till his death; and it was, we believe, not until a comparatively recent period that the very curious nature of the process was made public. It is now known that the metallochrome is a result of galvanic action; and that the coloured spots are formed by a layer of oxygen, or of some other chemical substance, deposited on the metal, in a manner somewhat analogous to that in which a layer of copper is deposited in the electrotype. Nobili's mode of proceeding was nearly as follows:—A plate of steel, or of platinum, was placed at the bottom of a convenient vessel, and in this was poured a small quantity of solution of acetate of lead. A wire was suspended over the plate, so as just to dip in the liquid, but not to actually touch the plate. The plate was placed in connection with one pole of a galvanic battery, while the wire was connected with the other; and a galvanic current was thus established, which gave rise to a series of coloured rings on the plate, surrounding the point immediately under the wire. As a wire was thus the means of producing coloured spots and rings, Nobili next tried to produce larger surfaces similarly coloured; and after many difficulties he succeeded, by means of one plate suspended over, but not in contact with, another, in producing surfaces of surpassing beauty. It is believed that these colours do not result from an actual corroding of the texture of the metal itself, but from a deposition thereon of a very thin layer, a layer which adheres very firmly to the metallic surface, but which is, at the same time, distinct from it, and can be removed from it by the agency of heat. The colours vary according to the varying thickness of this minute film.

About four years ago Mr. Gassiot communicated to the Royal Society a method which he had adopted for producing coloured devices on a metal plate by similar means. A highly polished steel-plate was placed in a porcelain soup-plate, and a filtered solution of acetate of lead was poured upon it. A piece of card-board, out of which the required device had been previously cut with a sharp knife, was then placed upon the steel plate. Over the card, and resting on it, there was fixed a ring of wood, a quarter of an inch thick, the inner circumference of which was of the same size as the figure. A convex copper-plate was made so that its outer edge might rest on the inner part of the wooden ring, and its centre placed near but not in actual contact with the card-board. Matters being thus arranged, the steel was connected with one pole of the battery, and the copper with another; and in less than half a minute a party-coloured device was produced on the steel through the perforation in the card. These colours varied according to the distance of the different parts of the copper-plate from the steel-plate; and when the experiment was tried with the concave side of the copper-plate downwards, instead of the convex, the same colours appeared, but in inverse order.

This beautiful art has been but little practised hitherto; but we may reasonably expect that it will be brought to the aid of the decorative arts when better known.

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*Muscles of the Hand.*—In the palm of the hand, and between the metacarpal bones, there are small muscles (*lumbricales* and *interossei*) which perform the finer motions,—expanding the fingers, and moving them in every direction with quickness and delicacy. These small muscles, attached to the near extremities of the bones of the fingers where they form the first joint, being inserted near the centre of motion, move the ends of the fingers with very great velocity. They are the organs which give the hand the power of spinning, weaving, engraving; and as they produce the quick motions of the musician's fingers, they are called by the anatomists *fabricinales*. The combined strength of all the muscles, in grasping, must be very great; indeed, the power is exhibited when we see a sailor hanging by a rope, and raising his whole body with one arm. What then must be the pressure upon the hand? It would be too much for the texture even of bones and tendons, and certainly for the blood-vessels and nerves, were not the palms of the hands, the inside of the fingers and their tips, guarded by cushions. To add to this purely passive defence there is a muscle, which runs across the palm, and more especially supports the cushion on the inner or ulnar edge: it acts powerfully as we grasp; and it is this muscle which, raising the edge of the palm, hollows it, and adapts it to lave water, forming the cup of Diogenes.—*Bell on the Hand.*